# PREDICT

Performance & Reliability Evaluation and Design by Information Combination & Tracking

PREDICT is a methodology developed by the Statistical Sciences Group at Los Alamos National Laboratory currently in use by the DOE weapons program and industrial manufacturing. This methodology:

- Provides a structured, quantitative approach for predicting complex system performance using state-of-the-art expert elicitation, statistical and reliability analysis, and knowledge management techniques.
- Displays reliabilities, uncertainties, and all underlying information in a browser-accessed knowledge base.
- Guides the capture of knowledge from experts concerning the construction of models that represent the composition of the system (e.g., components, subsystems, assemblies), its processes, interactions with other systems and the environment, and operating conditions.
- Utilizes and combines all available information for constructing and updating (e.g., with Bayesian methods) performance models: relevant data from similar systems, historical data, lessons learned, manufacturing/ design specifications, operational experience, and expert judgement.
- Quantifies, models, propagates, and analyzes uncertainties, providing appropriate uncertainties in the predictions of performance or reliability.
- Provides the best possible performance prediction under uncertainty for the given body of evidence.
- Provides updating analysis tools to predict performance when new data/information becomes available, when assumptions or conditions change, and when "what-if" results are needed for predicting potential situations.
- Dynamically monitors or tracks performance and uncertainty changes as changes occur. (See figure.)
- Provides guidance for planning decisions on where to invest time, money, and effort to cost-effectively improve performance and/or reduce uncertainties.
- Minimizes "surprise" results in performance when systems are tested or are placed in-demand under strained or abnormal environments.

PREDICT is used for predicting concept system performance and estimating reliability (under uncertainty) prior to prototyping, testing, or production. New concept designs are important for the auto industry to meet tightening emissions requirements and for maintaining a competitive edge in the world market.
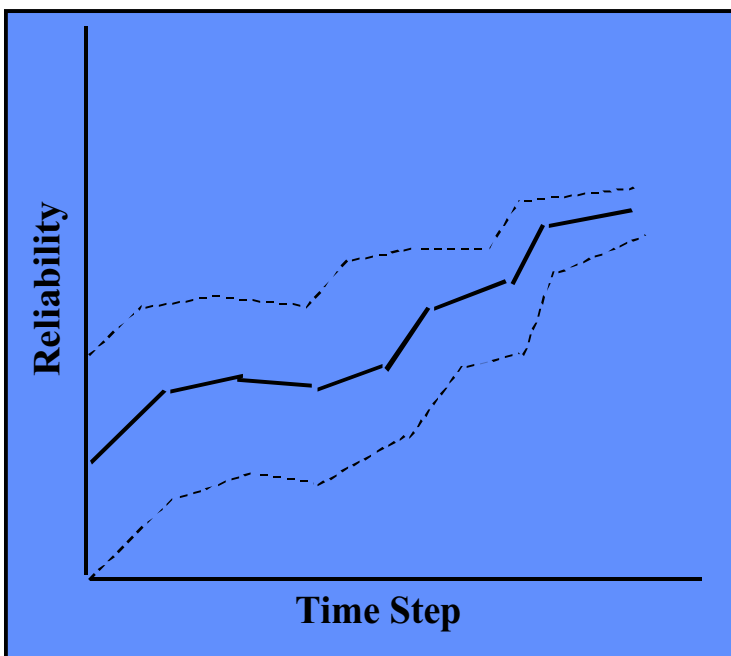
System performance is tracked from initial concept through its complete life cycle. Effects of design changes (e.g., improvements in reliability and/or reduction of uncertainty) can be made using the methodology prior to manufacture. Uncovering and anticipating problems before production minimizes recalls and aids in warranty and maintenance scheduling determinations.

CONTACT: Sallie Keller-McNulty, Group Leader, (505) 665-3957, sallie@lanl.gov
Jane M. Booker, Principal Investigator, (505) 667-1479, jmb@lanl.gov
Statistical Sciences Group, MS F600 (http://ww.lanl.gov/tsa1/)
Los Alamos National Laboratory
Los Alamos, NM 87545

| Reliability | ——— |
| Uncertainties | - - - - - |

The reliability and associated uncertainties are monitored through time involving various stages of development and changes to system. The reliability shoiuld be generally increasing over time, and the width of the uncertainty bands should be narrowing over time.